PATENT

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In the Matter of the Application of:	Lowell E. Kolb *et al.*
Serial No.:	09/813,257
Filed:	March 1, 2001
Entitled:	FILLER MATERIAL AND PRETREATMENT OF PRINTED CIRCUIT BOARD COMPONENTS TO FACILITATE APPLICATION OF CONFORMAL EMI COATING
Docket No.:	10001844-1

Group Art Unit: 2827

Examiner: T. Dinh

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Certificate of Mailing (37 C.F.R. 1.8(a))

I hereby certify that this correspondence is deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on: August 11, 2003

August 11, 2003
Date of Deposit

By: Michael G. Verga; Reg. No. 39,410

08/14/2003 JADD01 00000078 082025 09813257
02 FC:1402 320.00 DA

APPEAL BRIEF PURSUANT TO 37 C.F.R. § 1.192

TABLE OF CONTENTS

REAL PARTY IN INTEREST

The real party in interest is Hewlett-Packard Company of Palo Alto, California. Hewlett-Packard Company derives its rights in this application by virtue of an assignment of the application by the inventors to Hewlett-Packard Company.

II. RELATED APPEALS AND INTERFERENCES

None.

III. STATUS OF CLAIMS

Claims 1 and 3-17 are currently pending in the present application, application number 09/813,257. According to the Final Office Action mailed on March 12, 2003 claims 1 and 3-17 stand finally rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,127,038 to *McCullough* (hereinafter "*McCullough*"); and, claims 6, 8-11, 13-14 and 17 stand finally rejected under 35 U.S.C. §103(a) as being unpatentable over *McCullough*. Accordingly, claims 1 and 3-17 are subject to appeal.

IV. STATUS OF AMENDMENTS

All amendments have been entered.

V. SUMMARY OF THE INVENTION

The present invention is directed to a printed circuit board comprising a printed wiring board with a plurality of components mounted thereon. There are relatively small gaps or spaces between leads of the mounted components. There may also be small gaps between neighboring components and/or between components and the printed wiring board. These various spaces are referred to in Applicant's application as "cavities." Such cavities may have more than one opening to the surface of the printed circuit board. Referring to the example depicted in Figure 9D of Applicant's application, reproduced below, the space defined by the combination of the body of each component 302, its leads 906 and the printed

wiring board 202, define a cavity. Such a cavity has an opening to the surface of the printed circuit board between neighboring leads. (*See*, Applicant's application, pg. 31, lns. 10-20.)

An electrically non-conductive filler material is disposed in the cavity and on the surface of the printed circuit board immediately surrounding the cavity so as to bridge across and at least partially infill the one or more openings of the cavity to render the cavity substantially inaccessible to subsequently-applied coatings. In the exemplary embodiment of Figure 9D, Applicant's claimed filler material is identified by reference numeral 902. In this example, filler material 902 is a non-electrically-conductive high viscosity material which is applied to the region of the printed circuit board so as to bridge across the opening(s) of each cavity to cover, enclose, encapsulate and seal the cavity. Oftentimes, the cavities are also at least partially infilled with filler material 902, as shown in the exemplary application illustrated in Figure 9D. (*See*, Applicant's application, pg. 31, ln. 31 to pg. 32, ln. 10.)

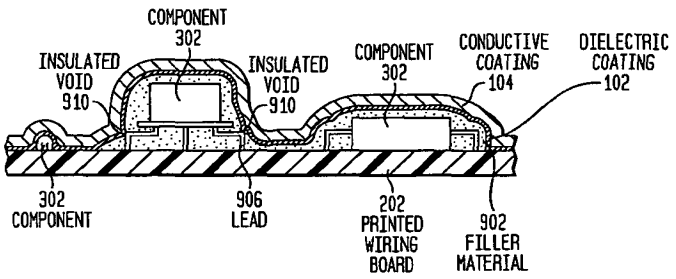

Figure 9D of Applicant's Invention

As shown in Applicants' Figure 9D, a dielectric coating 102 is applied to the surface of filler material 902, and to surfaces of the printed circuit board not previously coated with filler material 902. Filler material 902 eliminates the requirement that dielectric coating 102 penetrate the noted cavities to coat component and board surfaces defining each cavity. Rather, dielectric coating 102, when applied to components covered with filler material 902, will coat completely such components due to the contiguous, contoured surface provided by filler material 902. Thus, selective applications of Applicant's filler material can convert an irregular and cratered printed circuit board surface to a contiguous surface having gradual transitions. (*See*, Applicant's application, pg. 32, lns. 11-19.)

Filler material 902 is preferably thixotropic, enabling it to be extended into and over cavities 900 while covering the top, side and other surfaces of the components 914. In one embodiment, filler material 902 is an epoxy such as any epoxy from the family of Bisphenol-

A epoxies mixed with amine hardner. A thermally cured epoxy is preferred due to the inability to directly apply UV radiation to filler material 902 that is disposed in cavities 900 due to shadows cast by components. In other embodiments, filler material 902 is either a latex based non-electrically conductive coating, such as HumiSeal TS300 epoxy, or a gray, two-part epoxy manufactured with glass bead spacers to control the bond line thickness, such as the epoxy ABLEBOND 9349K. (*See*, Applicant's application, pg. 32, ln. 30 to pg. 33, ln. 2.)

VI. ISSUES

1. Whether the Examiner improperly rejected claims 1 and 3-17 as being anticipated by *McCullough* when *McCullough* neither discloses, teaches nor suggests a filler material that bridges across and partially infills cavities of a circuit board to render the cavity substantially inaccessible to subsequently-applied coatings.

2. Whether the Examiner improperly rejected claims 6, 8-11, 13-14 and 17 as being unpatentable over *McCullough*, when *McCullough* neither discloses, teaches or suggests a filler material as defined in their respective independent claims, nor the specific features recited in dependent claims 6, 8-11, 13-14 and 17.

VII. GROUPING OF CLAIMS FOR THE PURPOSES OF THIS APPEAL

In paragraph 2 of the Office Action the Examiner states that claims 1 and 3-17 are anticipated by *McCullough*. However, the Examiner substantively addresses the recitations of only claims 1, 3-5, 7, 12 and 14. In paragraph 4 of the Office Action, the Examiner states that claims 6, 8-11, 13-14 and 17 are unpatentable over *McCullough*. Thus, it is Applicant's understanding that the Examiner has grouped the pending claims into two groups: claims 1, 3-5, 7, 12 and 14 and claims 6, 8-11, 13-14 and 17.

The following groups of claims are considered to be separately patentable for the purposes of this Appeal only:

(a) Claim(s) 1, 3-5, 7-12, 14, 15;

(b) Claim(s) 16; and

(c) Claim(s) 6, 13 and 17.

VIII. ARGUMENT

The following arguments address various combinations of the above groups of claims based on the similarity of the rejections levied by the Examiner and/or by the similarity of the Applicant's basis for traversing such rejections.

A. McCullough Neither Discloses, Teaches Nor Suggests Applicant's Filler Material Recited in Claims 1 and 12

In the Final Office Action mailed March 12, 2003, the Examiner rejected claims 1 and 12 under 35 U.S.C. § 102(e) as being anticipated by *McCullough*. Specifically, the Examiner asserts that *McCullough's* first coating layer 14 bridges across and at least partially infills the one or more openings of a cavity on a printed circuit board, wherein the filler material renders the cavity substantially inaccessible to subsequently-applied coatings, thereby anticipating Applicant's filler material as recited in independent claims 1 and 12.

McCullough is directed to conformally coating a printed circuit board to prevent corrosion and short circuit from exposure to humid conditions. (*See*, *McCullough*, col. 1, lns. 5-10.) The particular problem of then-conventional conformal coatings addressed by *McCullough* is that the coatings delaminate or pull away from the corners of leads and boards or otherwise develop cracks which wick moisture during temperature and humidity cycles. (*See*, *McCullough*, col. 1, lns. 36-41.) Such cracks and areas of delamination form pockets between the coating and the printed circuit board which may "entrap water and dissolve and/or dissociate contaminants confined therein." (*See*, *McCullough*, col. 1, lns. 5-10, 33-44.) To overcome such problems, the *McCullough* conformal coating comprises two layers: a first coating layer 14 deposited on printed circuit board surfaces 20, component surface 22 and lead surfaces 24, and a second coating layer 16 deposited on first coating 14. Together, layers 14 and 16 provide a continuous, stratified coating which is sealed and corrosion resistant over the surface of the board, components and respective leads. (*See*, *McCullough*, col. 3, lns. 8-19.)

The Examiner asserts that *McCullough's* layer 14 is analogous to Applicant's claimed filler material because layer 14 prevents subsequently-applied coating layer 16 from entering the cavities on the printed circuit board. (*See*, Office Action, para. 2.) This is incorrect. *McCullough's* layer 16, as noted, is part of a continuous, stratified coating 14, 16 which is sealed over all surfaces of the circuit board, components and respective leads, including

surfaces that define the walls of cavities on the printed circuit board. In other words, layer 14 does not prevent layer 16 from entering cavities; rather both layer 14 and layer 16 coat surfaces of the printed wiring board, components and component leads, including those surfaces which define cavities.

This is illustrated in *McCullough's* only figure, Figure 1, which is reproduced to the right. *McCullough's* Figure 1 is a sectional view of a printed circuit board comprising a printed circuit board with a single component mounted thereon. There is a cavity defined by the component, its leads and the printed circuit board. All component surfaces 22, lead surfaces 24 and printed circuit board surfaces 20 that define the noted cavity, are coated by both, layer 14 and layer 16, as shown in *McCullough's* Figure 1. (*See, McCullough*, col. 2, lns. 35-43; col. 3, lns. 2-5.)

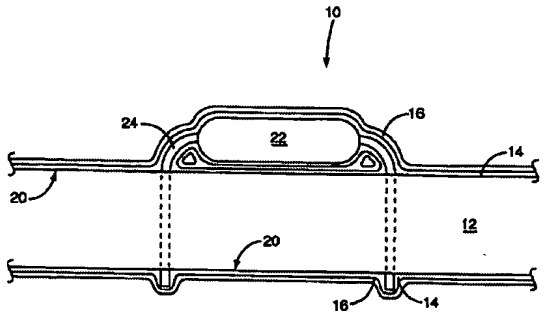

Figure 1 of McCullough

There is no disclosure, teaching or suggestion in *McCullough* that first coating layer 14 bridge across openings in the noted cavity, such as those between neighboring leads. Nor could there be. If first coating layer 14 bridged the cavity openings as recited in Applicant's independent claim 12, or renders the cavity substantially inaccessible to subsequently-applied coating layer 16, as recited in Applicant's independent claim 1, first coating layer 14 would prevent *McCullough's* second coating layer 16 from being applied at the surface of first coating layer 14 in the noted cavity. As shown in Figure 1, this is clearly not the case as layer 16 coats layer 14 on all surfaces including those defining the noted cavity.

Furthermore, were *McCullough's* first coating layer 14 to function as alleged by the Examiner, it would prevent *McCullough* from achieving its purpose of providing the disclosed dual-layer conformal coating 14,16 covering all surfaces of the printed circuit board. Thus, layer 14 does not – and must not - bridge across the cavity, nor render the cavity substantially inaccessible to subsequently-applied coatings. Hence, contrary to the assertions made by the Examiner, *McCullough* actually teaches away from having its layer 14 serve as a filler material as claimed by Applicant in independent claims 1 and 12.

For at least the above reasons, Applicant respectfully asserts that the Examiner has failed to meet his burden of providing a reference that either expressly or inherently teaches

each of the claim elements of the Applicant's invention. Accordingly, Applicant respectfully asserts that the Section 102 rejections of independent claims 1 and 12 should be reversed.

B. The Examiner Failed to Identify Features in the Art of Record Analogous to Applicant's Claim 16, leaving the Office Action without a *prima facie* rejection.

In paragraph 2 of the Office Action in which Section 102 rejections are set out, the Examiner notes that "[a]s to claims 12, and 15-16, *McCullough* discloses...." However, there is no reference or discussion of the limitations recited in Applicant's claim 16. Claim 16 is directed to a conductive coating covering the dielectric coating (recited in Applicant's claim 15 from which claim 16 depends) which is previously applied to surfaces of the printed circuit board, including Applicant's claimed filler material (recited in Applicant's claim 1 from which claim 15 depends). (*See*, Applicant's claim 16, below.) *McCullough* is completely silent with regard to conductive coatings.

Because the Examiner has failed to identify any teaching of *McCullough* or the other art of record that teaches or suggests Applicant's claimed conductive coating in combination with Applicant's dielectric coating of claim 15 and filler material of claim 1, the Examiner has failed to establish a *prima facie* case of anticipation. Accordingly, the rejection of claim 16 should be reversed.

C. The Examiner's Reasoning In Making The Obviousness Rejection Of Claims 6, 13 and 17 is incorrect, leaving the Office Action without a prima facie rejection.

The Examiner has also rejected claims 6, 13 and 17 under 35 U.S.C. § 103(a) as being unpatentable over *McCullough*. These rejections are also misplaced.

Claims 6, 13 and 17 recite that the filler material is thixotropic. In Applicant's application, thixotropic was defined in connection with a dielectric coating 102:

> Specifically, the material properties dielectric coating 102 include primarily a combination of viscosity and adhesion sufficient to enable dielectric coating 102 to be applied via atomization spray techniques and, once applied, to adhere to the surface in the immediate vicinity of where it was applied. In other words, adhesiveness of dielectric coating 102 issufficient to prevent dielectric coating 102 from separating from the surface to which it is applied, a phenomenon commonly referred to as dewetting.
>
> (*See*, Applicant's application, pg. 11, lns. 19-24.)

Subsequently, Applicant notes that:

> Although the viscosity can vary, filler material 902 is preferably thixotropic, enabling it to be extruded into and over cavities 900 while covering the top, side and other surfaces of components 914.
>
> (*See*, Applicant's application, pg. 32, lns. 20-22.)

An Examiner may only establish a *prima facie* case of obviousness when "the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Bell, 991 F.2d 781, 783, 26 USPQ2d 1529, 1531 (Fed. Cir. 1993). In asserting that the prior art "suggested" the claimed subject matter, however, an Examiner must realize that "the mere fact that the prior art may be modified in the manner suggested by the Examiner neither makes the modification prima facie obvious unless the prior art suggested the desirability of the modification." In re Fritch, 972 F.2d 1260, 1266, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992).

In the Final Office Action the Examiner admits that *McCullough* does not disclose a thixotropic filler material, yet states that it would have been obvious to use thixotropic epoxy because *McCullough* teaches to use an epoxy mixed with amine hardner. This is incorrect. *McCullough* teaches only that epoxy can be used as layer 14. There is no discussion regarding the properties of layer 14 in *McCullough*. Contrary to the Examiner's assertions, *McCullough* lacks any suggestion to provide thixotropic epoxy or other material for any purpose, let alone to serve as Applicant's claimed filler material. Thus, the fact that *McCullough's* layer 14 could be modified as suggested by the Examiner to be thixotropic does not provide a prima facie case of obviousness because the prior art does not suggest such a modification. Accordingly, the rejection of claims 6, 13 and 17 should be reversed.

IX. CONCLUSION

For the reasons noted above, the Applicants submit that the pending claims define patentable subject matter. Accordingly, the Applicants request that the Examiner's rejection of these claims be reversed and that the pending application be passed to issue.

Respectfully submitted,

Dated: August 11, 2003

Michael G. Verga, Esq.
Reg. No. 39,410
Attorney for Applicants
Telephone: (617) 439-2871

APPENDIX: CLAIMS ON APPEAL

1. A printed circuit board comprising:

a printed wiring board;

a plurality of components mounted on said printed wiring board, wherein the printed circuit board has a cavity with one or more openings to the surface of the printed circuit board; and

an electrically non-conductive filler material disposed in the cavity and on the surface of the printed circuit board immediately surrounding the cavity so as to bridge across and at least partially infill the one or more openings of the cavity, wherein the filler material renders the cavity substantially inaccessible to subsequently-applied coatings.

3. The printed circuit board of claim 1, wherein the cavity comprises:
a volume of space defined by leads of a component, the component body and said printed wiring board, wherein the volume of space has a plurality of openings to the surface of the printed circuit board between neighboring component leads.

4. The printed circuit board of claim 1, wherein the cavity comprises:
a volume of space between neighboring components mounted on the printed wiring board.

5. The printed circuit board of claim 1, wherein the cavity comprises:
a volume of space between a component mounted on the printed wiring board and the printed wiring board.

6. The printed circuit board of claim 1, wherein said filler material is thixotropic.

7. The printed circuit board of claim 1, wherein said filler material is an epoxy.

8. The printed circuit board of claim 7, wherein said epoxy is one of the family of Bisphenol-A epoxies mixed with an amine hardner.

9. The printed circuit board of claim 7, wherein said epoxy is a thermally cured epoxy.

10. The printed circuit board of claim 7, wherein said epoxy is a latex based non-electrically conductive epoxy.

11. The printed circuit board of claim 1, wherein the subsequently-applied coating comprises:

a layer of dielectric coating that conformingly coats exposed surfaces of the printed circuit board including the filler material, the dielectric coating formed of a low viscosity material that facilitates accurate application of the dielectric coating using a spray atomized technique, wherein the at least one of the cavity openings is sufficiently large to prevent the dielectric coating from bridging across the cavity opening without the presence of the filler material.

12. A printed circuit board comprising:

a printed wiring board;

a plurality of components having a device body mounted on said printed wiring board to form one or more regions of the printed circuit board having a highly variable and cavitatious surface including a plurality of cavities defined by component leads, the component body adjacent the series of leads, and a portion of the printed wiring board below the series of leads, wherein each cavity includes a plurality of openings to the surface of the printed circuit board; and

a layer of non-electrically-conductive filler material conformingly adhered to printed circuit board surfaces in the one or more regions to provide a contoured, contiguous filler material surface having gradual transitions, wherein the filler material bridges across the cavity openings and at least partially infills the cavities.

13. The printed circuit board of claim 12, wherein said filler material is thixotropic.

14. The printed circuit board of claim 12, wherein said filler material is an epoxy.

15. The printed circuit board of claim 14, further comprising:

a low viscosity, high adherence dielectric coating that, when applied and cured, covers predetermined portions of said printed circuit board including at least a portion of the

one or more regions coated with said filler material, wherein the filler material prevents the dielectric coating from entering the plurality of cavities.

16. The printed circuit board of claim 15, further comprising:

a conductive coating covering said dielectric coating and portions of the printed circuit board not covered by the dielectric coating, wherein the dielectric coating and the conductive coating form a conformal EMI shield that adheres to and conforms with the printed wiring board surfaces.

17. The printed circuit board of claim 14, wherein said filler material is thixotropic.

1231909.1

PATENT

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In the Matter of the Application of:	Lowell E. Kolb *et al.*
Serial No.:	09/813,257
Filed:	March 1, 2001
Entitled:	FILLER MATERIAL AND PRETREATMENT OF PRINTED CIRCUIT BOARD COMPONENTS TO FACILITATE APPLICATION OF CONFORMAL EMI COATING
Docket No.:	10001844-1

Group Art Unit: 2827

Examiner: T. Dinh

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Certificate of Mailing (37 C.F.R. 1.8(a))

I hereby certify that this correspondence is deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on: August 11, 2003

August 11, 2003
Date of Deposit

By: Michael G. Verga; Reg. No. 39,410

APPEAL BRIEF PURSUANT TO 37 C.F.R. § 1.192

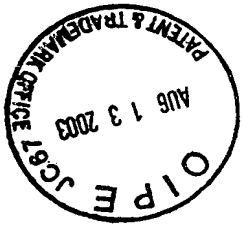

TABLE OF CONTENTS

I. REAL PARTY IN INTEREST

The real party in interest is Hewlett-Packard Company of Palo Alto, California. Hewlett-Packard Company derives its rights in this application by virtue of an assignment of the application by the inventors to Hewlett-Packard Company.

II. RELATED APPEALS AND INTERFERENCES

None.

III. STATUS OF CLAIMS

Claims 1 and 3-17 are currently pending in the present application, application number 09/813,257. According to the Final Office Action mailed on March 12, 2003 claims 1 and 3-17 stand finally rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,127,038 to *McCullough* (hereinafter "*McCullough*"); and, claims 6, 8-11, 13-14 and 17 stand finally rejected under 35 U.S.C. §103(a) as being unpatentable over *McCullough*. Accordingly, claims 1 and 3-17 are subject to appeal.

IV. STATUS OF AMENDMENTS

All amendments have been entered.

V. SUMMARY OF THE INVENTION

The present invention is directed to a printed circuit board comprising a printed wiring board with a plurality of components mounted thereon. There are relatively small gaps or spaces between leads of the mounted components. There may also be small gaps between neighboring components and/or between components and the printed wiring board. These various spaces are referred to in Applicant's application as "cavities." Such cavities may have more than one opening to the surface of the printed circuit board. Referring to the example depicted in Figure 9D of Applicant's application, reproduced below, the space defined by the combination of the body of each component 302, its leads 906 and the printed

wiring board 202, define a cavity. Such a cavity has an opening to the surface of the printed circuit board between neighboring leads. (*See*, Applicant's application, pg. 31, lns. 10-20.)

An electrically non-conductive filler material is disposed in the cavity and on the surface of the printed circuit board immediately surrounding the cavity so as to bridge across and at least partially infill the one or more openings of the cavity to render the cavity substantially inaccessible to subsequently-applied coatings. In the exemplary embodiment of Figure 9D, Applicant's claimed filler material is identified by reference numeral 902. In this example, filler material 902 is a non-electrically-conductive high viscosity material which is applied to the region of the printed circuit board so as to bridge across the opening(s) of each cavity to cover, enclose, encapsulate and seal the cavity. Oftentimes, the cavities are also at least partially infilled with filler material 902, as shown in the exemplary application illustrated in Figure 9D. (*See*, Applicant's application, pg. 31, ln. 31 to pg. 32, ln. 10.)

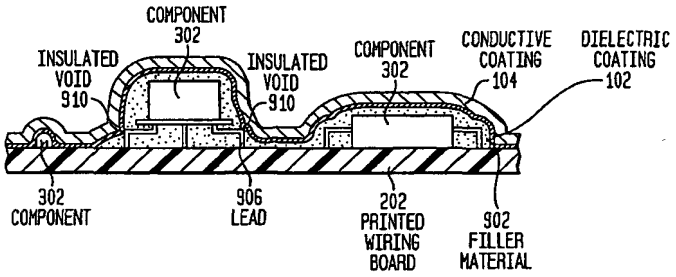

Figure 9D of Applicant's Invention

As shown in Applicants' Figure 9D, a dielectric coating 102 is applied to the surface of filler material 902, and to surfaces of the printed circuit board not previously coated with filler material 902. Filler material 902 eliminates the requirement that dielectric coating 102 penetrate the noted cavities to coat component and board surfaces defining each cavity. Rather, dielectric coating 102, when applied to components covered with filler material 902, will coat completely such components due to the contiguous, contoured surface provided by filler material 902. Thus, selective applications of Applicant's filler material can convert an irregular and cratered printed circuit board surface to a contiguous surface having gradual transitions. (*See*, Applicant's application, pg. 32, lns. 11-19.)

Filler material 902 is preferably thixotropic, enabling it to be extended into and over cavities 900 while covering the top, side and other surfaces of the components 914. In one embodiment, filler material 902 is an epoxy such as any epoxy from the family of Bisphenol-

A epoxies mixed with amine hardner. A thermally cured epoxy is preferred due to the inability to directly apply UV radiation to filler material 902 that is disposed in cavities 900 due to shadows cast by components. In other embodiments, filler material 902 is either a latex based non-electrically conductive coating, such as HumiSeal TS300 epoxy, or a gray, two-part epoxy manufactured with glass bead spacers to control the bond line thickness, such as the epoxy ABLEBOND 9349K. (*See*, Applicant's application, pg. 32, ln. 30 to pg. 33, ln. 2.)

VI. ISSUES

1. Whether the Examiner improperly rejected claims 1 and 3-17 as being anticipated by *McCullough* when *McCullough* neither discloses, teaches nor suggests a filler material that bridges across and partially infills cavities of a circuit board to render the cavity substantially inaccessible to subsequently-applied coatings.

2. Whether the Examiner improperly rejected claims 6, 8-11, 13-14 and 17 as being unpatentable over *McCullough*, when *McCullough* neither discloses, teaches or suggests a filler material as defined in their respective independent claims, nor the specific features recited in dependent claims 6, 8-11, 13-14 and 17.

VII. GROUPING OF CLAIMS FOR THE PURPOSES OF THIS APPEAL

In paragraph 2 of the Office Action the Examiner states that claims 1 and 3-17 are anticipated by *McCullough*. However, the Examiner substantively addresses the recitations of only claims 1, 3-5, 7, 12 and 14. In paragraph 4 of the Office Action, the Examiner states that claims 6, 8-11, 13-14 and 17 are unpatentable over *McCullough*. Thus, it is Applicant's understanding that the Examiner has grouped the pending claims into two groups: claims 1, 3-5, 7, 12 and 14 and claims 6, 8-11, 13-14 and 17.

The following groups of claims are considered to be separately patentable for the purposes of this Appeal only:

(a) Claim(s) 1, 3-5, 7-12, 14, 15;

(b) Claim(s) 16; and

(c) Claim(s) 6, 13 and 17.

VIII. ARGUMENT

The following arguments address various combinations of the above groups of claims based on the similarity of the rejections levied by the Examiner and/or by the similarity of the Applicant's basis for traversing such rejections.

A. McCullough Neither Discloses, Teaches Nor Suggests Applicant's Filler Material Recited in Claims 1 and 12

In the Final Office Action mailed March 12, 2003, the Examiner rejected claims 1 and 12 under 35 U.S.C. § 102(e) as being anticipated by *McCullough*. Specifically, the Examiner asserts that *McCullough's* first coating layer 14 bridges across and at least partially infills the one or more openings of a cavity on a printed circuit board, wherein the filler material renders the cavity substantially inaccessible to subsequently-applied coatings, thereby anticipating Applicant's filler material as recited in independent claims 1 and 12.

McCullough is directed to conformally coating a printed circuit board to prevent corrosion and short circuit from exposure to humid conditions. (*See*, *McCullough*, col. 1, lns. 5-10.) The particular problem of then-conventional conformal coatings addressed by *McCullough* is that the coatings delaminate or pull away from the corners of leads and boards or otherwise develop cracks which wick moisture during temperature and humidity cycles. (*See*, *McCullough*, col. 1, lns. 36-41.) Such cracks and areas of delamination form pockets between the coating and the printed circuit board which may "entrap water and dissolve and/or dissociate contaminants confined therein." (*See*, *McCullough*, col. 1, lns. 5-10, 33-44.) To overcome such problems, the *McCullough* conformal coating comprises two layers: a first coating layer 14 deposited on printed circuit board surfaces 20, component surface 22 and lead surfaces 24, and a second coating layer 16 deposited on first coating 14. Together, layers 14 and 16 provide a continuous, stratified coating which is sealed and corrosion resistant over the surface of the board, components and respective leads. (*See*, *McCullough*, col. 3, lns. 8-19.)

The Examiner asserts that *McCullough's* layer 14 is analogous to Applicant's claimed filler material because layer 14 prevents subsequently-applied coating layer 16 from entering the cavities on the printed circuit board. (*See*, Office Action, para. 2.) This is incorrect. *McCullough's* layer 16, as noted, is part of a continuous, stratified coating 14, 16 which is sealed over all surfaces of the circuit board, components and respective leads, including

surfaces that define the walls of cavities on the printed circuit board. In other words, layer 14 does not prevent layer 16 from entering cavities; rather both layer 14 and layer 16 coat surfaces of the printed wiring board, components and component leads, including those surfaces which define cavities.

This is illustrated in *McCullough's* only figure, Figure 1, which is reproduced to the right. *McCullough's* Figure 1 is a sectional view of a printed circuit board comprising a printed circuit board with a single component mounted thereon. There is a cavity defined by the component, its leads and the printed circuit board. All component surfaces 22, lead surfaces 24 and printed circuit board surfaces 20 that define the noted cavity, are coated by both, layer 14 and layer 16, as shown in *McCullough's* Figure 1. (*See, McCullough*, col. 2, lns. 35-43; col. 3, lns. 2-5.)

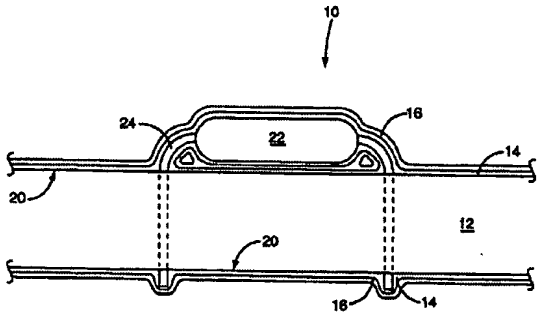

Figure 1 of McCullough

There is no disclosure, teaching or suggestion in *McCullough* that first coating layer 14 bridge across openings in the noted cavity, such as those between neighboring leads. Nor could there be. If first coating layer 14 bridged the cavity openings as recited in Applicant's independent claim 12, or renders the cavity substantially inaccessible to subsequently-applied coating layer 16, as recited in Applicant's independent claim 1, first coating layer 14 would prevent *McCullough's* second coating layer 16 from being applied at the surface of first coating layer 14 in the noted cavity. As shown in Figure 1, this is clearly not the case as layer 16 coats layer 14 on all surfaces including those defining the noted cavity.

Furthermore, were *McCullough's* first coating layer 14 to function as alleged by the Examiner, it would prevent *McCullough* from achieving its purpose of providing the disclosed dual-layer conformal coating 14,16 covering all surfaces of the printed circuit board. Thus, layer 14 does not – and must not - bridge across the cavity, nor render the cavity substantially inaccessible to subsequently-applied coatings. Hence, contrary to the assertions made by the Examiner, *McCullough* actually teaches away from having its layer 14 serve as a filler material as claimed by Applicant in independent claims 1 and 12.

For at least the above reasons, Applicant respectfully asserts that the Examiner has failed to meet his burden of providing a reference that either expressly or inherently teaches

each of the claim elements of the Applicant's invention. Accordingly, Applicant respectfully asserts that the Section 102 rejections of independent claims 1 and 12 should be reversed.

B. The Examiner Failed to Identify Features in the Art of Record Analogous to Applicant's Claim 16, leaving the Office Action without a *prima facie* rejection.

In paragraph 2 of the Office Action in which Section 102 rejections are set out, the Examiner notes that "[a]s to claims 12, and 15-16, *McCullough* discloses...." However, there is no reference or discussion of the limitations recited in Applicant's claim 16. Claim 16 is directed to a conductive coating covering the dielectric coating (recited in Applicant's claim 15 from which claim 16 depends) which is previously applied to surfaces of the printed circuit board, including Applicant's claimed filler material (recited in Applicant's claim 1 from which claim 15 depends). (*See*, Applicant's claim 16, below.) *McCullough* is completely silent with regard to conductive coatings.

Because the Examiner has failed to identify any teaching of *McCullough* or the other art of record that teaches or suggests Applicant's claimed conductive coating in combination with Applicant's dielectric coating of claim 15 and filler material of claim 1, the Examiner has failed to establish a *prima facie* case of anticipation. Accordingly, the rejection of claim 16 should be reversed.

C. The Examiner's Reasoning In Making The Obviousness Rejection Of Claims 6, 13 and 17 is incorrect, leaving the Office Action without a prima facie rejection.

The Examiner has also rejected claims 6, 13 and 17 under 35 U.S.C. § 103(a) as being unpatentable over *McCullough*. These rejections are also misplaced.

Claims 6, 13 and 17 recite that the filler material is thixotropic. In Applicant's application, thixotropic was defined in connection with a dielectric coating 102:

> Specifically, the material properties dielectric coating 102 include primarily a combination of viscosity and adhesion sufficient to enable dielectric coating 102 to be applied via atomization spray techniques and, once applied, to adhere to the surface in the immediate vicinity of where it was applied. In other words, adhesiveness of dielectric coating 102 issufficient to prevent dielectric coating 102 from separating from the surface to which it is applied, a phenomenon commonly referred to as dewetting.
>
> (*See*, Applicant's application, pg. 11, lns. 19-24.)

Subsequently, Applicant notes that:

> Although the viscosity can vary, filler material 902 is preferably thixotropic, enabling it to be extruded into and over cavities 900 while covering the top, side and other surfaces of components 914.
>
> (*See*, Applicant's application, pg. 32, lns. 20-22.)

An Examiner may only establish a *prima facie* case of obviousness when "the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Bell, 991 F.2d 781, 783, 26 USPQ2d 1529, 1531 (Fed. Cir. 1993). In asserting that the prior art "suggested" the claimed subject matter, however, an Examiner must realize that "the mere fact that the prior art may be modified in the manner suggested by the Examiner neither makes the modification prima facie obvious unless the prior art suggested the desirability of the modification." In re Fritch, 972 F.2d 1260, 1266, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992).

In the Final Office Action the Examiner admits that *McCullough* does not disclose a thixotropic filler material, yet states that it would have been obvious to use thixotropic epoxy because *McCullough* teaches to use an epoxy mixed with amine hardner. This is incorrect. *McCullough* teaches only that epoxy can be used as layer 14. There is no discussion regarding the properties of layer 14 in *McCullough*. Contrary to the Examiner's assertions, *McCullough* lacks any suggestion to provide thixotropic epoxy or other material for any purpose, let alone to serve as Applicant's claimed filler material. Thus, the fact that *McCullough's* layer 14 could be modified as suggested by the Examiner to be thixotropic does not provide a prima facie case of obviousness because the prior art does not suggest such a modification. Accordingly, the rejection of claims 6, 13 and 17 should be reversed.

IX. CONCLUSION

For the reasons noted above, the Applicants submit that the pending claims define patentable subject matter. Accordingly, the Applicants request that the Examiner's rejection of these claims be reversed and that the pending application be passed to issue.

Respectfully submitted,

Dated: August 11, 2003

Michael G. Verga, Esq.
Reg. No. 39,410
Attorney for Applicants
Telephone: (617) 439-2871

APPENDIX: CLAIMS ON APPEAL

1. A printed circuit board comprising:

a printed wiring board;

a plurality of components mounted on said printed wiring board, wherein the printed circuit board has a cavity with one or more openings to the surface of the printed circuit board; and

an electrically non-conductive filler material disposed in the cavity and on the surface of the printed circuit board immediately surrounding the cavity so as to bridge across and at least partially infill the one or more openings of the cavity, wherein the filler material renders the cavity substantially inaccessible to subsequently-applied coatings.

3. The printed circuit board of claim 1, wherein the cavity comprises:
a volume of space defined by leads of a component, the component body and said printed wiring board, wherein the volume of space has a plurality of openings to the surface of the printed circuit board between neighboring component leads.

4. The printed circuit board of claim 1, wherein the cavity comprises:
a volume of space between neighboring components mounted on the printed wiring board.

5. The printed circuit board of claim 1, wherein the cavity comprises:
a volume of space between a component mounted on the printed wiring board and the printed wiring board.

6. The printed circuit board of claim 1, wherein said filler material is thixotropic.

7. The printed circuit board of claim 1, wherein said filler material is an epoxy.

8. The printed circuit board of claim 7, wherein said epoxy is one of the family of Bisphenol-A epoxies mixed with an amine hardner.

9. The printed circuit board of claim 7, wherein said epoxy is a thermally cured epoxy.

10. The printed circuit board of claim 7, wherein said epoxy is a latex based non-electrically conductive epoxy.

11. The printed circuit board of claim 1, wherein the subsequently-applied coating comprises:

a layer of dielectric coating that conformingly coats exposed surfaces of the printed circuit board including the filler material, the dielectric coating formed of a low viscosity material that facilitates accurate application of the dielectric coating using a spray atomized technique, wherein the at least one of the cavity openings is sufficiently large to prevent the dielectric coating from bridging across the cavity opening without the presence of the filler material.

12. A printed circuit board comprising:

a printed wiring board;

a plurality of components having a device body mounted on said printed wiring board to form one or more regions of the printed circuit board having a highly variable and cavitatious surface including a plurality of cavities defined by component leads, the component body adjacent the series of leads, and a portion of the printed wiring board below the series of leads, wherein each cavity includes a plurality of openings to the surface of the printed circuit board; and

a layer of non-electrically-conductive filler material conformingly adhered to printed circuit board surfaces in the one or more regions to provide a contoured, contiguous filler material surface having gradual transitions, wherein the filler material bridges across the cavity openings and at least partially infills the cavities.

13. The printed circuit board of claim 12, wherein said filler material is thixotropic.

14. The printed circuit board of claim 12, wherein said filler material is an epoxy.

15. The printed circuit board of claim 14, further comprising:

a low viscosity, high adherence dielectric coating that, when applied and cured, covers predetermined portions of said printed circuit board including at least a portion of the

one or more regions coated with said filler material, wherein the filler material prevents the dielectric coating from entering the plurality of cavities.

16. The printed circuit board of claim 15, further comprising:

a conductive coating covering said dielectric coating and portions of the printed circuit board not covered by the dielectric coating, wherein the dielectric coating and the conductive coating form a conformal EMI shield that adheres to and conforms with the printed wiring board surfaces.

17. The printed circuit board of claim 14, wherein said filler material is thixotropic.

1231909.1